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MEASUREMENT OF CORNEAL AND CRYSTALLINE LENS MISALIGNMENT RELATIVE TO THE VISUAL AXIS

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Purpose To measure the misalignment between the corneal and crystalline lens axes relative to the visual axis. To evaluate experimental errors involved in the Purkinje I and IV Reflection Pattern Evaluation technique for the assessment of eye rotations in strabismus detection.

Methods Pilot measurements were made in five cyclopeged eyes (one eye per subject) and repeated in two eyes. Ocular components were measured using a non-phakometric method. Horizontal misalignment of Purkinje images I, III and IV, relative to the visual axis, was measured using a modified slit lamp biomicroscope. Equations previously described by Phillips et al. (J. Cataract Refract. Surg. 14, 129-135, 1988) for calculation of IOL tilt and decentration were applied to determine corneal and crystalline lens alignment.

Results Preliminary findings reveal that the corneal axis (rotated about a point 13.6 mm behind the corneal vertex, the eye's assumed centre of rotation) is tilted by 0.4° to 4.6° temporally relative to the visual axis (approximately angle kappa). Relative to the corneal axis, the lens also exhibits 2.4° to 4.9° of tilt (lens rotation is assumed to occur about its anterior surface vertex) such that its nasal edge moves forward in addition to 0.08 mm nasalward to 0.10 mm temporalward decentration. Repeat readings indicate a precision of within 1.5° of corneal axis tilt, 0.5° of lens tilt and 0.10 mm of lens decentration.

Conclusions Within the error limits of the technique, our results indicate that the corneal and lens axes are misaligned when the eye is in its primary position, unaccommodated. It follows that none of the eyes measured possessed a true optical axis. The likely difference in the relative orientation of the corneal and crystalline lens axes in right and left eyes - yet to be established - limits the accuracy of the Purkinje I and IV Reflection Pattern Evaluation technique, which ideally assumes the existance of well-defined optical axes in both eyes.

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A STUDY OF LENS CELL GROWTH LEADING TO POSTERIOR CAPSULE OPACIFICATION.

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Purpose To investigate factors that influence lens epithelial cell growth on the posterior capsule and intraocular lens (IOL) after cataract surgery using an *in vitro* capsular bag model.

Methods A sham cataract operation was performed on human donor eyes (including anterior capsulorhexis and removal of soft lens matter). The capsular bag was dissected free, pinned flat on a plastic petri dish, incubated with EMEM in the presence and absence of serum and observed by phase and darkfield microscopy for up to 45 days. In some experiments an IOL was implanted. At the end point capsules were studied by EM and immunocytohistochemistry.

Results After a delay cells could be seen growing on the posterior capsule, both in the presence and absence of serum. In serum the posterior capsule was totally covered by a confluent monolayer of cells at 5.9 days and 7.3 days for capsules aged <40years and >60 years respectively (n=11). Capsules cultured in the absence of serum showed an exaggerated age effect of growth. Significant capsular wrinkling became apparent, increasing in length and number as time progressed, causing a marked rise in capsular tension. These regions increasingly scattered light and actin filament bundles could be seen running along and at right angles to the wrinkles. The cells also became multilayered across the whole posterior capsule.

Conclusions Cell growth occurs on the posterior capsule and anterior surface of the IOL both in the presence and absence of serum. The resilient cell growth of human lens epithelial cells explains many of the visual problems that complicate extra capsular cataract surgery.

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GROWTH OF HUMAN LENS EPITHELIAL CELLS ON THE ANTERIOR LENS CAPSULE IN VITRO

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Purpose To asses the in-vitro growth characteristic of human lens epithelial (HLE) cells on the anterior lens capsule using computer aided image analysis.

Methods Epithelial cells of 25 human anterior lens capsules, removed during cataract extraction, were cultured in special petri dishes (in minimal essential medium with 10%FCS) for 3 weeks. Cells remained attached to the anterior lens capsule, which was stretched out flat and fixed at the dish bottom (cells up). At days 0,1,2,3,7,14 and 21 phase contrast microscopic photographs were taken, which were digitalized and stored on compact discs for further analysis. The capsule area covered with cells, cell density and cell front progression were determined using a Power Mac 7100 and the NIH image program (vers.1.55). All parameters were related to donor age and time after operation by regression analysis.

Results Directly after operation (day 0) 49±8% (mean±SEM)of the capsule area was covered with HLE cells. The initial polygonal (epithelial) cells then either vanished (died, n=5) or changed in part to a "flat" cell type (n=20).
On these 20 capsules cell growth started at the1st to 3rd day after the operation. At day 7 the whole capsule was covered with cells in all cases. At this time multilayers occured.
In the growing (flat cell) populations cell size increased with time and cell density logarithmically decreased from 288 ±41 (SEM) cells/mm2 on day 0 to 66±10 cells/mm2 on day 21, respectively.
Cell front progression was about 3 to 7 µm per day.
The capsule area covered with cells did not correlate with donor age, while cell density showed a significant correlation to donor age beyond day 3. Younger patients had smaller cells, i.e., higher cell densities.

Conclusions
HLE cells remaining attached to the anterior capsule after cataract extraction show a particular growth characteristic. Longitudinal monitoring of cell growth on the capsule using computer aided image analysis turned out feasible.
Our model may be used for further research on anterior and posterior capsule opacification.

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ENDOTHELIAL RESPONSE AND BLOO-AQUEOUS BARRIER BREAKDOWN FOLLOWING PHACOEMULSIFICATION.

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Purpose: To evaluate the morphological and functional alteration of the corneal endothelium and the blood-aqueous barrier (BAB) breakdown following phacoemulsification.

Methods: 18 patients (age 67.4 ± 7.6 years) with senile non complicated cataracts were studied.Exams were performed before and three months after uncomplicated phacoemulsification by the same surgeon.We have analyzed the corneal endothelium by fluorophotometry (Kc.ca) and contact specular microscopy and the BAB by laser photometry.

Results: There was a postoperative significant increase in the endothelial permeability (Kc.ca pre: 3.5 ± 1.2 x 10^{-3} min^{-1} and Kc.ca post: 4.8 ± 0.8 x 10^{-3} min^{-1})($p < 0.01$) three months after surgery.There had been a 21% endothelial loss three months postoperatively A moderate rupture of the BAB in the early postoperative period was found.

Conclusions: The endothelium but not the BAB remains disturbed in the third postoperative month.